(3 × 24 plus 3); the third of 101 (4 × 24 plus 5); the fourth of 127 (5 × 24 plus 7). The resulting curve possesses 24 waves, no two of them alike in form, and some highly irregular in contour. The effect of blowing air through a slit against this disk is to produce a disagreeable sound, quite lacking in unitary character, and indeed suggesting intermittence.

The second wave-disk is constructed with the same perturbed harmonics, but with their amplitudes diminishing in order. This disk produces similar effects, but with more approach to a unitary character.

In the third disk there are also 24 fundamental waves, but there are no harmonics of the lower terms, the superposed ripples being perturbed harmonics of the fifth, sixth, and seventh orders. Their numbers are 6 × 24 plus 6; 7 × 24 plus 7; and 8 × 24 plus 8; being, in fact, three harmonics of a fundamental 25. This disk gives a distinctly dual sort of sound; for the ear hears the fundamental quite separate from the higher tones, which seem in themselves to blend to a unitary effect. There is also an intermittence corresponding to each revolution of the disk, like a beat.

The fourth disk resembles the preceding; but the gap between the fundamental and the three perturbed harmonics has been filled by the addition of three true harmonics. This disk is the first in this research which gives a real timbre, though it is a peculiar one: it preserves, however, a unitary character, even when the slit is tilted in either direction. The 24 waves in this disk all rake forward like the teeth of a circular saw, but with multiform ripples upon them. The quality of tone becomes more crisp when the slit is tilted so as to slope across the teeth, and more smooth when in the reverse direction.

The fifth disk, which is larger, has 40 waves at its edge; these are cut with curves of all sorts, taken hap-hazard from various combinations of pure harmonics in all sorts of proportions and varieties, no two being alike, there maxima and minima of the separate waves being neith isochronous nor of equal amplitude. This disk gives an entirely unmusical effect, amid which a fundamental tone is heard, accompanied by a sort of rattling sound made up of intermittent and barely recognizable tones.

The sixth disk is derived from the preceding by selecting eight only of the waves, and repeatiug them five times around the periphery. In this case each set of eight acts as a single long curve, giving beats, with a slow rotation, and a low tone (accompanied always by the rattling mixture of higher tones) when the speed is increased.

The seventh disk was constructed by taking 24 waves of perfect sinusoidal form, and superposing upon them a series of small ripples of miscellaneous shapes and irregular sizes, but without essentially departing from the main outline. This disk gives a timbre in which nothing can be separated from the fundamental tone, either with vertical or tilted slit.

The eighth and last disk consists of another set of 24 perfect waves, from the sides of which irregular ripples have been carved away by hand, with the file, leaving, however, the summits and the deepest parts of the hollows untouched, so that the maxima and minima are isochronous and of equal amplitude. This disk gives also a definite timbre of its own, a little raucous in quality, but still distinctly having a musical unity about it.

We have every reason, therefore, to conclude that the ear will recognize as possessing true musical quality, as a timbre, combinations in which the constituents of the sound vary in their relative intensity and phase from wave to wave.

What, then, is *a timbre?* Dr. Kœnig would be the first to recognize that these last experiments, though of deepest interest, do not afford a final answer to the question. We may not yet be in a position to frame a new definition as to what constitutes a timbre, but we may at least conclude that, whenever that definition can be framed, it will at least include several varieties, including the non-periodic kinds with multiform waves, as well as those that are truly periodic with uniform waves. We must not on that account, however, rush to the conclusion that the theory of von Helmholtz as to the nature of timbre has been overthrown. The corrections introduced into lunar theory by Hansen and Newcomb have not overturned the splendid generalizations of Newton. What we can and must confess is that we now know that the acoustic theory of von Helmholtz is, like the lunar theory of Newton, correct only as a first approximation. It has been the distinctive merit of Dr. Kœnig to indicate to us the magnitude of the correcting terms, and to supply us not only with a rich store of experimental facts but with the means of prosecuting the research synthetically beyond the point to which he himself has attained.

In thanking Dr. Kœnig for the courtesy which he has shown to this Society in bringing over his apparatus and in demonstrating its use to us, we must join in congratulating him on the patience, perspicacity, and skill with which he has carried out his researches. We know that his exceptional abilities as experimentalist and constructor have done more than those of any other investigator to make the science of experimental acoustics what it is to-day; and we must unite in wishing him long life and prosperity to complete the great work on which already he has advanced so far.

THE GEOLOGY OF ROUND ISLAND.

BOTANISTS have been a little perplexed as to the exact geological age of some of the islands in the Indian Ocean, and the current statements on the subject are by no means accordant. Any exact information on the subject seems, therefore, worth placing on record.

Round Island is a minute island, about two miles in diameter, which lies north-east of Mauritius, and about 13 miles distant. It was visited last November by Mr. William Scott, Assistant to the Director of Forests and Botanical Gardens, Mauritius, accompanied by Surgeon H. H. Johnston.

There is only one point where landing can be effected in calm weather; the end of November was therefore chosen for the visit as being the best season for landing. Unfortunately, the season at this time was very dry, so that the whole of the vegetation was in a dormant state, and little could be done in the way of procuring good specimens.

"The only trees," Mr. Scott writes, "of any size to be found on the island, are the Palms:—*Latania Loddigesii*, *Hyophorbe amaricaulis*, *Dictyosperma alba*, var. *aurea*, and the screw-pine *Pandanus Vandermeeschii*. These trees look stunted, and grow in clumps mixed up together where any root-hold is to be found. There were only at that time two or three grasses to be found, and these were in a very dry state. One or two Passifloras [probably introduced] and *Asclepiadaceæ* were also found. On these two latter, the wild goats which inhabit the island in hundreds, appear to exist."

Mr. Scott made a very careful collection of the rocks composing the island. His specimens were sent to Kew and were submitted to Prof. Judd, F.R.S., who very kindly examined them. He furnished me with the following report, which he has kindly allowed me to publish.

W. T. THISELTON DYER.

Royal Gardens, Kew, December 4.

Science Schools, South Kensington, S.W.,
September 29.

MY DEAR DYER,—Immediately upon my return to town I have, as I promised you, examined the specimens

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from Round Island, with the notes on the same by Mr. Scott. My conclusions are as follows:—

The rocks of the island appear to be entirely of organic or volcanic origin.

The lower part of the island consists of a limestone made up of shell and coral (?) detritus, cemented into a hard and crystalline rock (see specimens 1, 3, 15). Masses of this rock of greater hardness than usual seem to have resisted denudation, and stand up as pinnacles among the overlying stratified tuffs (specimen 14). Fissures in the various rocks are filled with a stalagmitic deposit of calcic carbonate (specimen 8). But the great mass of the island would appear to be made up of stratified *palagonite tuffs*, some coarse-grained, others very fine-grained. These palagonite tuffs, which closely resemble the similar rocks in Sicily and Iceland, are very beautiful and interesting varieties; and, besides the hydrous basic glass known as palagonite, contain various beautiful zeolites and other minerals (specimens 4, 5, 6, 7, 9, 10, 11, 12).

The lavas associated with these tuffs appear to occur both as ejected blocks and in lava-currents, and consist of a highly scoriaceous basalt rich in olivine (specimens 2 and 13).

These are the general facts concerning the structure of the island which are revealed by a general examination of the specimens with Mr. Scott's interesting notes.

I return these last with this letter. The specimens I retain for the present, as some among them will, I think, repay a minuter study than I have yet been able to afford time for. JOHN W. JUDD.

NOTES.

THE Medals and Funds to be given at the anniversary meeting of the Geological Society of London on February 20 have been awarded by the Council as follows: the Wollaston Medal to Prof. J. W. Judd, F.R.S.; the Murchison Medal to Prof. W. C. Brögger, of Christiania; the Lyell Medal to Prof. T. McKenny Hughes, F.R.S.; and the Bigsby Medal to Dr. G. M. Dawson; the balance of the Wollaston Fund to Mr. R. Lydekker; that of the Murchison Fund to Mr. R. Baron; and portions of the Lyell Fund to Messrs. C. J. Forsyth Major and G. W. Lamplugh.

AT the meeting of the Institution of Civil Engineers on Tuesday, M. Carnot, President of the French Republic, was elected an honorary member.

THE forty-fourth annual general meeting of the Institution of Mechanical Engineers will be held on Thursday evening, January 29, and Friday evening, the 30th, at 25 Great George Street, Westminster. The chair will be taken by the President, Mr. Joseph Tomlinson, at half-past seven p.m. on each evening. After the presentation of the annual report, and the transaction of other business, the following papers will be read and discussed, as far as time permits:—On some different forms of gas furnaces, by Mr. Bernard Dawson, of Malvern; on the mechanical treatment of moulding sand, by Mr. Walter Bagshaw, of Batley; fourth report of the research committee on friction: experiments on the friction of a pivot bearing.

THE Royal Microscopical Society will hold its annual meeting on Wednesday evening, the 21st inst., at 8 o'clock. The President will deliver an address.

THE annual general meeting of the Royal Meteorological Society will be held at 25 Great George Street, Westminster, on Wednesday, the 21st inst., at 8.15 p.m. It will be preceded by an ordinary meeting, beginning at 7 p.m., at which the following papers will be read:—Note on a peculiar development of cirrus cloud observed in Southern Switzerland, by Mr. Robert H. Scott, F.R.S.; and some remarks on dew, by Colonel W. F Badgley, F.R.Met.Soc.

THE Council of the Royal Meteorological Society have arranged to hold at 25 Great George Street, Westminster, from March 17 to 20, an Exhibition of rain gauges, evaporation gauges, percolation gauges, and kindred instruments. The Exhibition Committee invite co-operation in this undertaking. They will also be glad to show any new meteorological instruments or apparatus invented, or first constructed, since last March; as well as photographs and drawings possessing meteorological interest. Anyone willing to co-operate in the proposed Exhibition should furnish Mr. William Marriott, the Secretary, not later than February 10, with a list of the articles he will be able to contribute, and an estimate of the space they will require.

THE Sanitary Institute has made arrangements for a course of sixteen lectures for the special instruction of those who may wish to obtain knowledge of the duties of sanitary officers. These lectures, which will be a continuation of previous courses, will be delivered at the Parkes Museum, and will be illustrated with diagrams, drawings, and models. The first lecture will be given on January 30 by Sir Douglas Galton, who will deal with ventilation, warming, and lighting. Among the other lecturers will be Mr. H. Law, Dr. Louis Parkes, and Prof. W. H. Corfield.

DR. SYMES THOMPSON will deliver at Gresham College, on January 20 and the three following days, a course of four lectures on the preservation of health. He will deal with questions relating to healthy homes, healthy schools, and the early detection and prevention of disease.

MR. A. SIDNEY OLLIFF, late assistant in the Museum, Sydney, has been appointed to the newly-instituted office of Government Entomologist in the Department of Agriculture, New South Wales. His duties will be chiefly the study of insects affecting fruits and crops, whether injurious or beneficial, and publishing reports on the results for the information of farmers and horticulturists. According to the latest news as to the new insect pest, Mr. Olliff will not lack employment.

M. PATOUILLARD has been elected President, and MM. Prillieux and de Seynes Vice-Presidents, of the Société Mycologique de France.

THE death is announced of M. Clavaud, Professor of Botany at Bordeaux, author of the "Flora de la Gironde," of which two parts only have appeared, embracing the *Thalamifloræ* and the *Calycifloræ*. The work is characterized by its beautiful plates, and by the attempts to place on a scientific basis the genetic relationship of the various species with one another.

MR. GEORGE W. ORMEROD, of Teignmouth, died on January 6, at the age of eighty. He had been a member of the Geological Society of London for fifty-eight years, and geologists owe much to him for his classified index to the *Quarterly Journal* and other publications.

ACCORDING to a telegram from Rusk, Texas, two sharp earthquake shocks were felt there on January 8. Chimneys were thrown to the ground, and people awakened by the violence of the oscillations.

AT the meeting of the French Meteorological Society on December 2, M. Angot communicated the results of comparisons of the pressure and temperature observations at the Eiffel Tower during 1889 with the low-level stations. The night maxima and minima of pressure are less marked on the Tower than at the lower levels, as is also the case with mountain observations, and inversely for the day maxima and minima. For individual readings small variable differences were found between the actual

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